AD-A167 393 ANNUAL REPORT ON CHEMICAL WARFARE-BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS(U) DEPUTY CHIEF OF STAFF FOR RESEARCH DEVELOPMENT AND ACQUISITION (ARMY) WASHINGTON D C JAN 85 1/1

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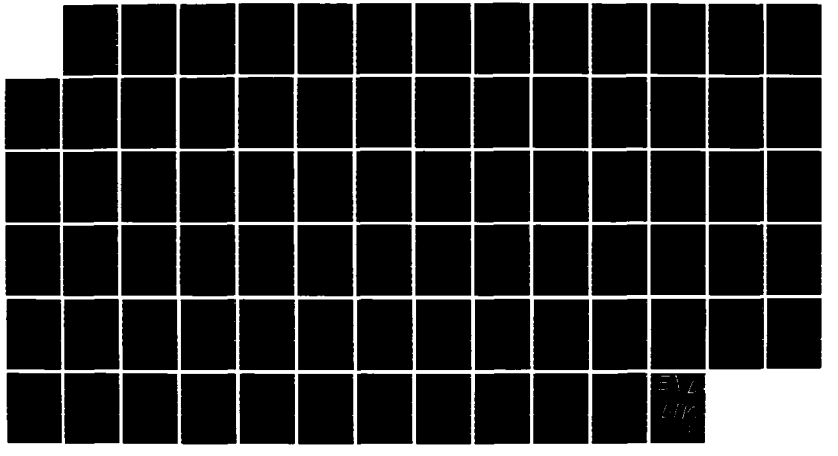

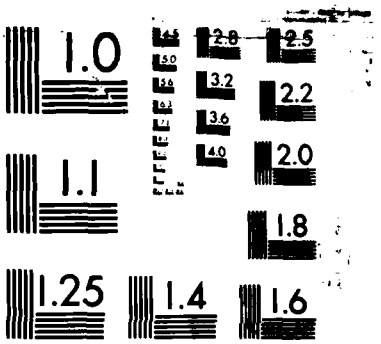

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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No 0704-0188
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1a REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS
2a SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT [illegible] has been approved for public release and sale; its distribution is unlimited. UNRESTRICTED
2b DECLASSIFICATION / DOWNGRADING SCHEDULE	
4 PERFORMING ORGANIZATION REPORT NUMBER(S) RCS: DD-USDRE(A) 1065	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION ODCSRDA 6b. OFFICE SYMBOL (If applicable) DAMA-CSS	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (City, State, and ZIP Code) The Pentagon Washington, D.C. 20310	7b. ADDRESS (City, State, and ZIP Code)
8a. NAME OF FUNDING / SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO / PROJECT NO / TASK NO. / WORK UNIT ACCESSION NO

11. TITLE (Include Security Classification)
DEPARTMENT OF DEFENSE ANNUAL REPORT ON CHEMICAL WARFARE-BIOLOGICAL DEFENSE RESEARCH RESEARCH PROGRAM OBLIGATIONS

12. PERSONAL AUTHOR(S)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
ANNUAL	FROM 83/10/1 TO 84/9/30	1985 January	

16. SUPPLEMENTARY NOTATION

17 COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)		
FIELD	GROUP	SUB-GROUP	OBLIGATIONS	PUBLIC LAW 91-121	FY 84
15	02		CHEMICAL	PUBLIC LAW 93-608	
			BIOLOGICAL	PUBLIC LAW 97-375	

19 ABSTRACT (Continue on reverse if necessary and identify by block number)

Public Law 93-608 requires the Department of Defense to make an annual report to Congress on the funds obligated for chemical warfare and biological defense research and procurement programs.

AD-A167 393

20 DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT ☐ DTIC USERS	21 ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a NAME OF RESPONSIBLE INDIVIDUAL ROBERT J. HARTMAN	22b TELEPHONE (Include Area Code) (202) 694-2153 22c OFFICE SYMBOL DAMA-CSS-C

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83 APR edition may be used until exhausted
All other editions are obsolete

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Block 9. Procurement Instrument Identification Number: For a contractor grantee report, enter the complete contract or grant number(s) under which the work was accomplished. Leave this block blank for in-house reports.

Block 10 Source of Funding (Program Element, Project, Task Area, and Work Unit Number(s)): These four data elements relate to the DoD budget structure and provide program and/or administrative identification of the source of support for the work being carried on. Enter the program element, project, task area, work unit accession number, or their equivalents which identify the principal source of funding for the work required. These codes may be obtained from the applicable DoD forms such as the DD Form 1498 (Research and Technology Work Unit Summary) or from the fund citation of the funding instrument. If this information is not available to the authoring activity, these blocks should be filled in by the responsible DoD Official designated in Block 22. If the report is funded from multiple sources, identify only the Program Element and the Project, Task Area, and Work Unit Numbers of the principal contributor.

Block 11. Title: Enter the title in Block 11 in initial capital letters exactly as it appears on the report. Titles on all classified reports, whether classified or unclassified, must be immediately followed by the security classification of the title enclosed in parentheses. A report with a classified title should be provided with an unclassified version if it is possible to do so without changing the meaning or obscuring the contents of the report. Use specific, meaningful words that describe the content of the report so that when the title is machine-indexed, the words will contribute useful retrieval terms.

If the report is in a foreign language and the title is given in both English and a foreign language, list the foreign language title first, followed by the English title enclosed in parentheses. If part of the text is in English, list the English title first followed by the foreign language title enclosed in parentheses. If the title is given in more than one foreign language, use a title that reflects the language of the text. If both the text and titles are in a foreign language, the title should be translated, if possible, unless the title is also the name of a foreign periodical. Transliterations of often used foreign alphabets (see Appendix A of MIL-STD-847B) are available from DTIC in document AD-A080 800.

Block 12. Personal Author(s): Give the complete name(s) of the author(s) in this order: last name, first name, and middle name. In addition, list the affiliation of the authors if it differs from that of the performing organization.

List all authors. If the document is a compilation of papers, it may be more useful to list the authors with the titles of their papers as a contents note in the abstract in Block 19. If appropriate, the names of editors and compilers may be entered in this block.

Block 13a Type of Report: Indicate whether the report is summary, final, annual, progress, interim, etc.

Block 13b Time Covered: Enter the inclusive dates (*year, month, day*) of the period covered, such as the life of a contract in a final contractor report.

Block 14 Date of Report: Enter the year, month, and day, or the year and the month the report was issued as shown on the cover.

Block 15 Page Count: Enter the total number of pages in the report that contain information, including cover, preface, table of contents, distribution lists, partial pages, etc. A chart in the body of the report is counted even if it is unnumbered.

Block 16 Supplementary Notation: Enter useful information about the report in hand, such as: "Prepared in cooperation with ..." "Translation of (or by) ..." "Symposium ..." If there are report numbers for the report which are not noted elsewhere on the form (such as internal series numbers or participating organization report numbers) enter in this block.

Block 17. COSATI Codes: This block provides the subject coverage of the report for announcement and distribution purposes. The categories are to be taken from the "COSATI Subject Category List" (DoD Modified), Oct 65, AD-624 000. A copy is available on request to any organization generating reports for DoD. At least one entry is required as follows:

Field - to indicate subject coverage of report.

Group - to indicate greater subject specificity of information in the report.

Sub-Group - if specificity greater than that shown by Group is required, use further designation as the numbers after the period (.) in the Group breakdown. Use only the designation provided by AD-624 000.

Example: The subject "Solid Rocket Motors" is Field 21, Group 08, Subgroup 2 (page 32, AD-624 000).

Block 18. Subject Terms: These may be descriptors, keywords, posting terms, identifiers, open-ended terms, subject headings, acronyms, code words, or any words or phrases that identify the principal subjects covered in the report, and that conform to standard terminology and are exact enough to be used as subject index entries. Certain acronyms or "buzz words" may be used if they are recognized by specialists in the field and have a potential for becoming accepted terms. "Laser" and "Reverse Osmosis" were once such terms.

If possible, this set of terms should be selected so that the terms individually and as a group will remain UNCLASSIFIED without losing meaning. However, priority must be given to specifying proper subject terms rather than making the set of terms appear "UNCLASSIFIED." Each term on classified reports must be immediately followed by its security classification, enclosed in parentheses.

For reference on standard terminology the "DTIC Retrieval and Indexing Terminology" DRIT-1979, AD-A068 500, and the DoD "Thesaurus of Engineering and Scientific Terms (TEST) 1968, AD-672 000, may be useful.

Block 19. Abstract: The abstract should be a pithy, brief (preferably not to exceed 300 words), factual summary of the most significant information contained in the report. However, since the abstract may be machine-searched, all specific and meaningful words and phrases which express the subject content of the report should be included, even if the word limit is exceeded.

If possible, the abstract of a classified report should be unclassified and consist of publicly releasable information (Unlimited), but in no instance should the report content description be sacrificed for the security classification.

NOTE: **An unclassified abstract describing a classified document may appear separately from the document in an unclassified context e.g., in DTIC announcement or bibliographic products. This must be considered in the preparation and marking of unclassified abstracts.**

For further information on preparing abstracts, employing scientific symbols, verbalizing, etc., see paragraphs 2.1(n) and 2.3(b) in MIL-STD-847B.

Block 20. Distribution / Availability of Abstract: This block must be completed for all reports. Check the applicable statement: "unclassified / unlimited," "same as report," or, if the report is available to DTIC registered users "DTIC users."

Block 21. Abstract Security Classification: To ensure proper safeguarding of information, this block must be completed for all reports to designate the classification level of the entire abstract. For CLASSIFIED abstracts, each paragraph must be preceded by its security classification code in parentheses.

Block 22a,b,c. Name, Telephone and Office Symbol of Responsible Individual: Give name, telephone number, and office symbol of DoD person responsible for the accuracy of the completion of this form.

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GENERAL INFORMATION

The accuracy and completeness of all information provided in the DD Form 1473, especially classification and distribution limitation markings, are the responsibility of the authoring or monitoring DoD activity.

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All information on the DD Form 1473 should be typed.

Only information appearing on or in the report, or applying specifically to the report in hand, should be reported. If there is any doubt, the block should be left blank.

Some of the information on the forms (e.g., title, abstract) will be machine indexed. The terminology used should describe the content of the report or identify it as precisely as possible for future identification and retrieval.

NOTE: **Unclassified abstracts and titles describing classified documents may appear separately from the documents in an unclassified context, e.g., in DTIC announcement bulletins and bibliographies. This must be considered in the preparation and marking of unclassified abstracts and titles.**

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In accordance with DoD 5200.1-R, Information Security Program Regulation, Chapter IV Section 2, paragraph 4-200, classification markings are to be stamped, printed, or written at the top and bottom of the form in capital letters that are larger than those used in the text of the document. See also DoD 5220.22-M, Industrial Security Manual for Safeguarding Classified Information, Section II, paragraph 11a(2). This form should be unclassified, if possible.

SPECIFIC BLOCKS

Block 1a. Report Security Classification: Designate the highest security classification of the report. (See DoD 5220.1-R, Chapters I, IV, VII, XI, Appendix A.)

Block 1b. Restricted Marking: Enter the restricted marking or warning notice of the report (e.g., CNWDI, RD, NATO).

Block 2a. Security Classification Authority: Enter the commonly used markings in accordance with DoD 5200.1-R, Chapter IV, Section 4, paragraph 4-400 and 4-402. Indicate classification authority.

Block 2b. Declassification / Downgrading Schedule: Indicate specific date or event for declassification or the notation, "Originating Agency Determination Required" or "OADR." Also insert (when applicable) downgrade to _____ on _____ (e.g., Downgrade to Confidential on 6 July 1983). (See also DoD 5220.22-M, Industrial Security Manual for Safeguarding Classified Information, Appendix II.)

NOTE: **Entry must be made in Blocks 2a and 2b except when the original report is unclassified and has never been upgraded.**

Block 3. Distribution/Availability Statement of Report: Insert the statement as it appears on the report. If a limited distribution statement is used, the reason must be one of those given by DoD Directive 5200.20, Distribution Statements on Technical Documents, as supplemented by the 18 OCT 1983 SECDEF Memo, "Control of Unclassified Technology with Military Application." The Distribution Statement should provide for the broadest distribution possible within limits of security and controlling office limitations.

Block 4. Performing Organization Report Number(s): Enter the unique alphanumeric report number(s) assigned by the organization originating or generating the report from its research and whose name appears in Block 6. These numbers should be in accordance with ANSI STD 239.23-74, "American National Standard Technical Report Number." If the Performing Organization is also the Monitoring Agency, enter the report number in Block 4.

Block 5. Monitoring Organization Report Number(s): Enter the unique alphanumeric report number(s) assigned by the Monitoring Agency. This should be a number assigned by a DoD or other government agency and should be in accordance with ANSI STD 239.23-74. If the Monitoring Agency is the same as the Performing Organization, enter the report number in Block 4 and leave Block 5 blank.

Block 6a. Name of Performing Organization: For in-house reports, enter the name of the performing activity. For reports prepared under contract or grant, enter the contractor or the grantee who generated the report and identify the appropriate corporate division, school, laboratory, etc., of the author.

Block 6b. Office Symbol: Enter the office symbol of the Performing Organization.

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Block 8b. Office Symbol: Enter the office symbol of the Funding/Sponsoring Organization.

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DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

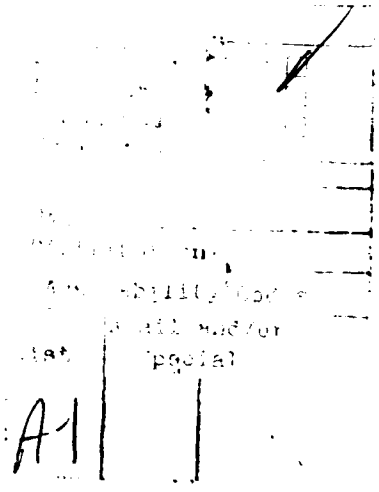
DEPARTMENT OF DEFENSE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

RCS: DD-USDRE(A) 1065



DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS
FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984
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INDEX

DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS
FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984
RCS: DD-USDRE(A) 1065

(ACTUAL DOLLARS)

	ARMY	NAVY AND MARINE CORPS	AIR FORCE	TOTAL
CHEMICAL WARFARE PROGRAM	207,690,000	22,881,000	28,180,000	258,751,000
RDTE	207,690,000	22,881,000	28,180,000	258,751,000
BIOLOGICAL RESEARCH PROGRAM	60,399,000	2,101,000	-0-	62,500,000
RDTE	60,399,000	2,110,000	-0-	62,500,000
ORDNANCE PROGRAM	24,737,000	-0-	-0-	24,737,000
RDTE	6,293,000	-0-	-0-	6,293,000
PROCUREMENT	18,444,000	-0-	-0-	18,444,000
TOTAL PROGRAM	292,826,000	24,982,000	28,180,000	345,988,000
RDTE	274,382,000	24,982,000	28,180,000	327,544,000
PROCUREMENT	18,444,000	-0-	-0-	18,444,000

DEPARTMENT OF DEFENSE
ANNUAL REPORT ON CHEMICAL WARFARE AND
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RDTE	60,399,000	2,110,000	-0-	62,500,000
ORDNANCE PROGRAM	24,737,000	-0-	-0-	24,737,000
RDTE	6,293,000	-0-	-0-	6,293,000
PROCUREMENT	18,444,000	-0-	-0-	18,444,000
TOTAL PROGRAM	292,826,000	24,982,000	28,180,000	345,988,000
RDTE	274,382,000	24,982,000	28,180,000	327,544,000
PROCUREMENT	18,444,000	-0-	-0-	18,444,000

DEPARTMENT OF DEFENSE

ANNUAL REPORT ON CHEMICAL WARFARE AND

BIOLOGICAL DEFENSE RESEARCH HUMAN TESTING

1 OCTOBER 1983 THRUGH 30 SEPTEMBER 1984

There have been no studies conducted within the Department of Defense during the reporting period that involved the use of human subjects for testing of Chemical or Biological agents.

ANNEX A

DEPARTMENT OF THE ARMY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

RCS: DD-USDRE (A) 1065

SECTION I

OBLIGATION REPORT ON CHEMICAL WARFARE PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE CHEMICAL WARFARE PROGRAM

During FY84, the Department of the Army obligated $207,690,000 for general research investigations, development and test of chemical warfare agents, weapons systems and defensive equipment.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$204,978,000	
Prior Year (PY)	2,712,000	
		In-House $ 62,820,000
TOTAL	$207,690,000	Contract $144,870,000

Breakdown of Program Areas

1. CHEMICAL RESEARCH			
a. Basic Research in Life Sciences	CFY	$ 14,676,000	
	PY	449,000	
			In-House $ 7,315,000
		$ 15,125,000	Contract $ 7,810,000
b. General Chemical Investigations: Exploratory Development	CFY	$ 14,300,000	
	PY	-0-	
			In-House $ 9,756,000
		$ 14,300,000	Contract $ 4,544,000
TOTAL: CHEMICAL RESEARCH	CFY	$ 28,976,000	
	PY	449,000	
			In-House $ 17,071,000
		$ 29,425,000	Contract $ 12,354,000

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development	CFY	$ 5,557,000		
	PY	-0-		
		$ 5,557,000	In-House $	4,021,000
			Contract $	1,536,000
b. Advanced Development	CFY	$ 12,284,000		
	PY	-0-		
		$ 12,284,000	In-House $	1,375,000
			Contract $	10,909,000
c. Engineering Development		$ -0-		
d. Testing		$ -0-		
TOTAL: LETHAL CHEMICAL PROGRAM	CFY	$ 17,841,000		
	PY	-0-		
		$ 17,841,000	In-House $	5,396,000
			Contract $	12,445,000

3.	**INCAPACITATING CHEMICAL PROGRAM**			
	a. Exploratory Development	CFY	$ 3,145,000	
		PY	-0-	
			$ 3,145,000	In-House $ 2,088,000 Contract $ 1,057,000
	b. Advanced Development		$ -0-	
	c. Engineering Development		$ -0-	
	d. Testing		-0-	
TOTAL:	**INCAPACITATING CHEMICAL PROGRAM**	CFY	$ 3,145,000	
		PY	$ -0-	
			$ 3,145,000	In-House $ 2,088,000 Contract $ 1,057,000
4.	**DEFENSIVE EQUIPMENT PROGRAM**			
	a. Exploratory Development			
	(1) Physical Protection Investigations	CFY	$ 13,174,000	
		PY	-0-	
			$ 13,174,000	In-House $ 6,963,000 Contract $ 6,211,000
	(2) Warning and Detection Investigations	CFY	$ 13,780,000	
		PY	-0-	
			$ 13,780,000	In-House $ 7,062,000 Contract $ 6,718,000

(3) Medical Defense Against Chemical Agents	CFY PY	$ 24,606,000 615,000	
		$ 25,221,000	In-House $ 11,045,000 Contract $ 14,176,000
TOTAL: Exploratory Development	CFY PY	$ 51,560,000 615,000	
		$ 52,175,000	In-House $ 25,070,000 Contract $ 27,105,000
b. Advanced Development			
(1) Chemical Defensive Systems	CFY PY	$ 27,293,000 -0-	
		$ 27,293,000	In-House $ 4,893,000 Contract $ 22,400,000
(2) Medical Defense Against Chemical Agents	CFY PY	$ 53,335,000 1,648,000	
		$ 54,983,000	In-House $ 2,619,000 Contract $ 52,364,000
TOTAL: Advanced Development	CFY PY	$ 80,628,000 1,648,000	
		$ 82,276,000	In-House $ 7,512,000 Contract $ 74,764,000

c. Engineering Development

(1) Decontamination Concepts and Material	CFY	$ 4,526,000		
	PY	-0-		
			In-House	$ 1,260,000
		$ 4,526,000	Contract	$ 3,266,000
(2) Collective Protective Systems	CFY	$ 5,709,000		
	PY	-0-		
			In-House	$ 1,341,000
		$ 5,709,000	Contract	$ 4,368,000
(3) Warning and Detection Equipment	CFY	$ 776,000		
	PY	-0-		
			In-House	$ 598,000
		$ 776,000	Contract	$ 178,000
(4) Individual Protection Equipment	CFY	$ 9,953,000		
	PY	-0-		
			In-House	$ 1,974,000
		$ 9,953,000	Contract	$ 7,979,000
TOTAL: Engineering Development	CFY	$ 20,964,000		
	PY	-0-		
			In-House	$ 5,173,000
		$ 20,964,000	Contract	$ 15,791,000

TOTAL: DEPENSIVE EQUIPMENT PROGRAM	CFY	$153,152,000	
	PY	2,263,000	
			In-House $ 37,775,000
		$155,415,000	Contract $117,660,000
5. TRAINING SUPPORT			
a. Training	CFY	$ 100,000	
	PY	-0-	
			In-House $ 93,000
TOTAL: TRAINING SUPPORT		$ 100,000	Contract $ 7,000
6. SIMULANT TEST SUPPORT	CFY	$ 1,764,000	
	PY	-0-	
			In-House $ 417,000
TOTAL: SIMULANT TEST SUPPORT		$ 1,764,000	Contract $ 1,347,000

EXPLANATION OF OBLIGATION

1. CHEMICAL RESEARCH

a. Basic Research in Life Sciences

This research provides a science base to support:

(1) **Chemical Defense Research.** This program includes new concepts and the elucidation of mechanisms of decontamination and contamination avoidance, individual and collective protection, chemical detection, identification and alarms, materials research, simulants and training systems.

(2) **Chemical Retaliatory Research.** This area includes research on chemical munitions, a search for new classes of chemical agents and studies on the reactions and properties of chemical threat agents.

During FY84:

Demonstrated the feasibility of using a specially impregnated charcoal to extend the life of charcoal filters against the blood agent cyanogen chloride.

Fabricated and evaluated several acoustic wave microsensors for detecting threat agents.

Developed a quantitative approach for the selection of simulants for threat agents.

Investigated the use of certain odoriferous compounds to determine the residual adsorption capacity of mask filters.

Constructed a vacuum system to measure sorption of chemical agents and decontaminants by polymers.

Studied the interfacial behavior of the blister agent mustard and the nerve agent GD under ambient conditions in an environmental chamber. This work is aimed to model and classify the interfacial behavior of threat agents.

Continued studies to determine if Surface Enhanced Raman Spectroscopy can be used to detect volatile chemical agents.

Continued work on the detection of chemical agents through mass spectrometry. A tandem mass spectrometer/mass spectrometer system, an advanced technique for selectively identifying compounds at low concentrations, is being studied.

Investigated the decontaminating capability of polymeric materials. Interaction of a simulant for the blister agent mustard and a polyurethane elastomer affected the sorption behavior of the latter.

Studied the back scattering signature of aerosol particles including mathematical methods for recognizing patterns in spectra of atmospheric aerosol mixtures to identify the presence of agents.

Emphasized the understanding of optical properties of aerosols and accompanying vapor which may be used for rapid remote detection and identification of chemical threat agents.

Measured internal wall shear stress and internal flow field for a viscous liquid in a spinning/nutating container to facilitate the design and analysis of liquid filled chemical munitions. This data is needed to validate computational fluid dynamics code describing the motion of a viscous liquid in a spinning vessel.

Synthesized nucleic acid (DNA) probes for several human pathogens which were used successfully for detecting and identifying microbes.

Developed a prototype calorimetric method for detection of trichothecene mycotoxins. (Mycotoxins are toxic substances produced by fungi and molds.)

Developed antisera for a viral simulant and a prototype mycotoxin.

Developed immunoassays for the detection and identification of chemical and biological threat agents.

Continued the development of enzymes and enzyme associated substances as methods for detection of viruses and toxins.

Clothing Shelters and Other Material Systems

The goal of this program is to develop technology for the development of clothing and other protective material systems that will minimize the effects of chemical/biological agents.

During FY84:

Investigated biologically active chemicals for possible application on garments and shelters to deactivate nerve chemical warfare (CW) agents.

Isolated microbial strains that produce enzymes capable of detoxifying G and V type nerve agents. Culture methods are being developed which will permit large scale production of CW detoxifying enzymes.

Isolated enzymes capable of degrading organophosphonates from hog kidney and the microorganism E. Coli.

Evaluated chemically modified cyclodextrins for the catalytic breakdown of CW agents.

Prepared chemical systems which can be attached to fabrics to detoxify agents. An enzyme capable of hydrolyzing nerve agents in aqueous solutions was immobilized covalently onto a cotton fabric.

Measured the binding and detoxifying properties of Chemical/Biological Warfare (CBW) substances by electron paramagnetic resonance spectroscopy.

Developed instrumentation to measure the properties governing the penetration of liquids through fibers, fabrics and films. This required the development of specialized methods for the measurement of surface tension and contact angle which indicate penetration resistance.

Awarded a contract to investigate the mechanisms of how materials and material composites repel liquids for agent resistance. Investigations into liquid repellency have indicated that underlying fabrics have a marked effect on the repellency of the system. A data base has been compiled which characterizes moisture vapor transport across fabric structures under variable environmental conditions.

Found that hydrophobic microporous membranes (MPMs) improve protection against liquid chemical agents, particularly in the presence of water. Limitations of these MPMs are being further evaluated.

Developed mass spectral analytical systems with higher sensitivity to evaluate vulnerability of military materials and CW protective systems to mycotoxin penetration.

Studied potential biological warfare (BW) toxins, Staphylococcal enterotoxin A (SEA) and cholera toxin (CT) to develop rapid detection assays and decontamination procedures.

Identified, measured and evaluated sensory and psychological variables and deficiencies experienced by mission-oriented protected posture (MOPP) encapsulated subjects during field tests with and without microclimatic cooling.

Made quantitative assessments of microspore sizes in carbon currently used in uniforms. The micropores were visualized by means of scanning transmission electron (STEM) photomicrography. The pore size was shown to correlate with CB agent permeability. Also developed computerized image analysis techniques to elucidate internal structure of carbon particles which are encapsulated within spheres. These techniques can be used to develop highly efficient CW neutralizing systems.

Measured changes in the camouflage characteristics, deterioration resistance and agent penetration of camouflage dyed and fungicidal-treated fabrics after subjecting these to accelerated weathering and burial treatments.

Medical Chemical Defense Research Program

This program addresses the medical defense against chemical agents. The objectives are to increase combat effectiveness and improve soldier survivability. Emphasis is placed on development of new technologies and methodologies to evaluate biological effects resulting from the current and potential chemical warfare agents and therapies. The results of this work are transitioned to exploratory development.

During FY84:

Identified and developed a test substance to assess the damage to skin from vesicant exposure.

Showed that anticholinesterase compounds reduce synaptic potentials in tissue cultures.

Defined more clearly the threshold dose of nerve agents that will produce seizures.

Investigated the therapeutic effects of anticonvulsants.

Investigated the mechanisms of the effect of the nerve agents on brain vasculature and seizure activity.

b. General Chemical Investigations: Exploratory Development

Chemistry and Effects of Threat Agents

The objective is to identify, synthesize, and characterize potential threat agents; to maintain modern technology in toxicology, chemometrics and analytical, organic and physical chemistry to support the chemical defense effort.

During FY84:

Synthesized and evaluated several potential threat agents.

Carried out chemical studies on analogs of designated threat agents.

Completed development of quantitative structure-activity relationship of G nerve agents versus toxicity using computer assisted molecular modeling analysis and display system.

Initiated theoretical chemical analysis for prediction of reactivity and toxicity of threat agents.

Developed a rapid and sensitive detection and identification technique for the blister agent mustard and its oxidation and hydrolysis products in aqueous solutions.

Completed inhalation toxicity and eye iritation studies on blister agent phosgene oxime (CX).

Published a report entitled "Physical Properties of Standard Agents, Candidate Agents, and Related Compounds at Several Temperatures".

Perfected a technique for measuring intermediate rate reactions by utilizing the Fourier Transform Infrared (FTIR) and transitioned it to BIGEYE Program. Prepared a report describing this technique.

Fabricated an aerosol/particle sampler which can effectively collect very small particles in minutes as opposed to hours needed for other samplers.

Expanded chemical agent data base.

Analysis and Integration of Chemical Defense Systems

The objective is to develop mathematical modeling and the data base to assess the foreign chemical and biological threat and explain the chemical and biological defense systems against the threat. To develop new models to evaluate the effects of chemical warfare agents on the battlefield and to use these models for the assessment of alternative concepts and designs. To provide other chemical analysts and wargames of Department of Defense with mathematical models and methodology for their analyses.

During FY84:

Completed a survey of sources of chemical data and potential users to establish the need for a chemical warfare/chemical biological defense information analysis center (IAC).

Formulated a mechanistic model to describe the transfer of sorbed liquids from surface to surface.

Determined contact hazard of residual blister agent mustard from concrete and plastic surfaces.

Developed a computer model to trace the release, transport, deposition and evaporation of intermediate volatility agents through wooded and urban terrains.

Quantified the particle size collection characteristics of the face mask inlet valve. Established the response of face mask to acid smoke and threat challenge materials.

Completed a biological field test data search for use in the validation of predictive models.

Formulated a model of the mechanisms of the physical removal of liquid contamination from surfaces by impinging sprays.

Completed front-end analyses on decontamination and reconnaissance systems and published reports.

Initiated an experimental program to quantify droplet spread history on battlefield materials.

Published several reports on the quantification of meterological parameters for the travel of chemical clouds in wooded, urban and complex terrains.

Developed predictive models to assess physiological response of personnel operating on the chemical and biological battlefield.

Toxin Defense Systems:

The objective of this area is to evolve new concepts, methods and material for providing defense for joint service application against potential threat toxins, and to apply biotechnology to detection of threat chemical and biological agents and toxins.

During FY84:

A method to detect T-2 toxin based on the specific binding of the toxin to immobilize antibodies followed by enzyme-mediated color development is being developed.

Established a cooperative effort with Defense Advanced Research Projects Agency to develop biomicrosensors for detection of toxins and other agents of biological origin.

Initiated efforts to develop a tactical toxin alarm having a modular capability for simultaneous multi-agent detection.

Established a data base on the properties of toxins. These data along with the intellegence information were used to rank potential threat toxins.

Held a symposium on the properties and characteristics of toxins at Chemical Research and Development Center.

Training Systems:

The objectives are to provide simulants and disseminating devices to train individuals and units to survive in chemical and biological warfare by recognition of attack and implementation of protection and decontamination procedures; to provide detection, decontamination, and protection equipment training aids; to provide training and trialing agents for assessment of CB defensive equipment and procedures.

During FY84:

Evaluated commercial and military spray systems, e.g., M11, personal decontamination apparatus.

Identified French and Canadian airburst simulators as best technical approach candidates.

Completed investigations on toxicological properties of CH (EA 4923) as a training simulant.

Supported force development test of chemical agents in a nuclear environment.

Chemical Protective Clothing and Equipment:

Hazard Assessment, Systems Analysis, Experimental Design and Materials for Chemical Protection:

The objectives of this program are to develop materials for use in chemical protective clothing and equipment.

During FY84:

Completed a contract which formulates and validates a mathematical model of agent permeation and diffusion through food packaging materials.

Established a prototype computerized data base containing limited experimental data on the physical and chemical properties of chemical agents and simulants in interactions with selected clothing, shelter, and food packaging materials.

Completed a plan for the development of an integrated protection ensemble for the battlefield of the 1990's.

Developed nuclear biological chemical (NBC) protected field feeding concepts incorporating Mobile Food Service Units with NBC protective covers and Modular Field Kitchens for use by the Marines for a highly mobile land force in the 1990's.

Initiated a follow-on evaluation that will determine protection limits for Battledress Overgarment.

Evaluated a test system for determining the susceptibility of different materials to penetration by BW agents. Clothing and shelter materials are currently under evaluation to determine relative penetrabilities to generate a data base.

Initiated studies to find an elastomer most resistant to CW agents and petroleum products. Began developing analytical methods and testing available elastomers and butyl rubber.

Tested the resistance of camouflage and chemical agent resistant designed military paints against fungal attack weathering. The chemical agent resistant coatings were less susceptible to agent degradation than the alkyd camouflage paints.

Testing technology is being developed to determine permeation of CW surrogate agents through various military materials. This includes developing a test cell, adapting MS/MS mass spectrometry techniques to detect surrogates at sub parts per billion level.

Continued development of improved chemical protective materials for protective suits including flame resistant versions. Several materials were chosen for accelerated development.

Developed non-carbon reactive resins that are capable of hydrolyzing nerve agents and mustard vapor in an aqueous environment. Investigations on the feasibility of incorporating these resins into practical fabric system which could be made into a reusable, launderable chemical protective suit are in progress.

Completed a contract for a mathematical computer simulation model which provides time-dependent spatial distribution of the liquid deposition and vapor dosage on potential targets. The model also estimates the time needed to respond to chemical attack casualties.

Compared the levels of chemical hazard and heat stress for European and Southwest Asia climates with levels defined for hypothetical protective clothings. These clothings incorporate alternative balances of chemical protection and heat stress reduction properties to improve survivability and combat effectiveness.

Conducted analysis of Air Force Food Issues in an NBC environment. Developed background information from reviews, discussions with major commands and observation tests at three Air Force Base Commissaries to generate alternatives for continued warehouse operations in an NBC environment.

Developed analytical methods to quantitatively determine the concentrations of the resin Polyox and the flame-retardant Phoschek from the CD fabrics. CD protective uniforms are treated with Polyox and Phoschek to insure their effectiveness under all battlefield conditions.

Developed methodology for determining the carbon distribution in the fabrics of CW protective garments. Methods include: electrical resistance, light transmission, sound transmission and wave propagation.

Continued contract effort in the following areas:

The development of encapsulated carbon particles and fibers. The goal is to improve the agent sorptivity of carbon materials under high humidity and to create launderable, reusable systems.

The development of reactive/sorptive fabrics designed to afford practical, durable, comfortable, reusable chemical protective fabrics and uniforms based on the non-carbon reactive resins.

The development of carbon-impregnated microporous fabrics with high moisture vapor permeability. This is aimed to make thin hydrophobic membranes containing carbon fibers that will provide improved protection against chemical agent penetration particularly in a wet environment.

The development of durable protective fabrics based on sorptive carbon spheres. The purpose of this work is to improve the durability and launderability of a chemical protective system (developed overseas) which showed promise for protection and reduced heat stress but suffered degradation of the fabric when wear-tested as a uniform.

Evaluated agent protection of candidate materials and worn uniforms through live agent testing.

2. LETHAL CHEMICAL PROGRAM

a. Exploratory Development

The objectives are to develop chemical agent/munition systems to provide a dependable deterrent and a valid retaliatory capability; to maintain advanced technology in agent chemistry weaponry to avoid any technological lag or surprise.

During FY84:

Continued exploratory development studies on new chemical agents, munition materials and prototype weapon designs.

Searched for new quick acting physically incapacitating agents that are effective by inhalation and absorption through skin.

Initiated structure activity relationships of potent analgesics and their analogs. Analogs of compounds of interest were identified by molecular modeling for further study.

Expanded investigations to discover new agents and methods of defeating protective ensembles and equipment.

Completed acute toxicology study for the chemical intermediates of a binary agent. Initiated sub-chronic toxicology study for the same.

Conducted binary agent controlled reactions in various sized reactors.

Evaluated thickeners, stabilizers and simulants for the binary intermediate volatility agents.

Conducted air gun chamber tests to relate agents and simulants, simulate dissemination characteristics and determine other viscoelastic properties of chemicals under investigation.

Chemical Agent Process Technology: The objective is to conduct process studies on incapacitant materials.

During FY84:

Conducted pilot plant investigations to develop large scale chemical processing methods for binary agent intermediates, incapacitating agents and material defeating agents. Studied two processes for manufacturing one of the principal binary intermediate volatility agents. Explored different synthesis routes for the manufacture of a new potential agent.

b. Advanced Development

Tactical Weapons System: The development for the Multiple Launch Rocket System (MLRS) was resumed with the release of FY84 funds. The Milestone I In-Process Review was accomplished and the validation phase of Advanced Development was initiated.

Conducted three flight tests successfully at the White Sands Missile Range using inert simulants. All the test objectives were met.

Awarded a contract to LTV Aerospace for the development of MLRS Chemical Warhead.

Designed a structure to support XM450 flight testing. Established a discrete design for XM450 fuze.

c. Testing

Two single shot firings were conducted for the XM877 binary IVA eight-inch projectile using residual FY83 funds.

3. INCAPACITATING CHEMICAL PROGRAM

a. Exploratory Development

The objectives are to discover new quick acting physically incapacitating compounds which are effective by inhalation and absorption through the skin; to synthesize and evaluate potent analgesics and volatile anesthetics.

During FY84:

Synthesized new compounds for evaluation as potential incapacitating agents. Explored the structure activity relationships of different classes of compounds.

Identified the analgesic fentanyl and its analogs through molecular modeling. Recommended these for further study which is now in progress.

Successfully fired the redesigned incapacitating agent 155mm projectile with simulant-filled submunitions.

Ordered equipment to modify a laboratory to work with incapacitating agents.

Performed literature searches on the pharmacology of the analgesic fentanyls.

Initiated reaction parameters for the agent EA 5825 in a small reactor.

b. Advanced Development

No obligations were incurred.

c. Engineering Development

No obligations were incurred.

d. Testing

No obligations were incurred.

4. DEFENSIVE EQUIPMENT PROGRAM

a. Exploratory Development

(1) Physical Protection Investigations

Chemical and Biological Decontamination and Contamination Avoidance

The objectives are to investigate procedures, designs and materials to enhance survivability of troops in a chemical, biological and radiological environment; to develop equipment to decontaminate personnel, personal items and military equipment; to improve the efficiency of the decontamination process.

During FY84:

Continued testing and evaluation of the effects of decontaminants on materials of military interest. The data is being incorporated into an NBC Materials Handbook.

Completed a literature survey to determine the effectiveness of fielded decontaminants on the battlefield. The identified data gaps will be addressed in the future decontamination effort.

Completed agent tests to determine the factors controlling the transfer of agents from one surface to another.

Continued a contractual effort to comparatively evaluate the technology for the development of a water based decontaminant to replace the currently used DS 2 and STB.

Investigated the possibility of dispersing substances into coatings which would catalytically destroy chemical agents as they permeate the film.

Investigated methods for automated decontamination processes.

Initiated biotechnological approaches to the decontamination process.

Initiated full-scale testing of expedient interior decontamination by using Herman-Nelson heater.

Awarded a contract for the evaluation of self-decontaminating paints.

Individual Protection

The objectives are to evolve concepts for individual protection against potential threat agents for joint service application; to develop a technical base to study the mechanism of chemical biological protective materials; to maintain a center of excellence in respiratory protection.

During FY84:

Two mask designs with 20 different features resulted from the contract on alternate design concepts. Many of these features including agent resistant facepiece materials, integrated voice meter/microphone capability, interchangeable hose coupling capability and simplified manufacturing methods were incorporated into the XM40 mask via Pre-Planned Product Improvement Program.

Fabricated respirator performance diagnostic equipment to assess respirators in simulated aerosol/vapor and actual agent exposure while breathing over a range of actual breathing rates.

Demonstrated that current military filter materials are effective against submicron aerosols.

Identified tetraethyleneglycol as a potential candidate for the production of nearly monodispersed test aerosols.

Determined protection factor assessment of standard and developmental respirators.

Established a test facility for evaluation of vapor/aerosol correlation and performed initial testing.

Initiated a program to determine shelf life of chemical protection overgarments.

Developed a model to predict the efficiency of particulate filtration.

Initiated the fabrication of an articulated mannequin to evaluate protective garments and ancillary equipment under dynamic conditions.

Studied the generation of measurement of submicron sized aerosols in relation to particulate filters.

Selected a lightweight, portable water purification device for further testing based on the screening results of three candidate systems. The filtering device satisfactorily removed four chemical agents from water.

Completed correction of critical deficiency in the standard chemical protective overgarment.

Fabricated improved permeable and impermeable versions of a new hood to interface with the XM40 mask.

Formulated and applied a four-level hierarchy to evaluate operational capabilities of general purpose tents on the CW battlefield to evaluate structural support and barrier material concepts.

Initiated development of a Chemically Hardened Shelter to replace the M51 shelter. Evaluated concept for Battalion Aid Station (BAS) and hardening the TEMPER tent for use as a Division Clearing Station (DCS). Established a technical data base for entryways and power systems.

Measured agent penetration of fabrics and polymer films for use as tent materials. Investigated fabrication of fabric polymer laminates and techniques for joining these laminates.

Completed tests which led to modification of flexible electrolyte beverage package and valve assembly to replenish lost body fluids through the mask to prevent shock and fatigue.

Developed three flavors for electrolyte liquid supplement for through-mask nourishment. Initiated a study on alternate uses for liquid rations.

Assembled a new protective clothing system concept for October demonstration. This system combines the latest technology in chemical protection, microclimatic conditioning, ballistics and flame protection.

Began work on a combat vehicle crewman's chemical protective flame-resistant uniform. This uniform will eliminate the need for wearing the chemical protective overgarment over the flame-resistant overalls.

Supported the development of the Aircrew Uniform, Integrated Battlefield. Tested the candidate materials for resistance to petroleum, oils, lubricants and toxic agents. Investigated the effects of vehicle exhaust on the sorptive capacity of the carbon-based materials.

Evaluated a West German mask feeding valve as a candidate system to provide through-mask feeding of liquid and non-liquid nutrients in addition to water and electrolyte beverage.

Identified membrane distillation and reverse osmosis as feasible processes for converting salt water into drinking water. This work was undertaken to meet the military requirements of drinking water in a combat environment.

Progressed on the construction of a Stirling engine. This was selected as the power source to drive a vapor compressed cooling system for an encapsulated individual soldier.

Improved the packaging system of fiberboard sheathing and polyethylene shrink wrap for unit loads of Meal Ready to Eat (MRE) rations. The improvements were based on the chemical agent and simulant tests of current multiple layers of the packaging system. Identified a new non-foil laminate material which promises to be chemical agent resistant for pallet loads of food in a contaminated environment.

Collective Protection

The objectives are to evolve concepts for collective protection against present and future threat agents for joint service application; to develop and maintain a technical base on the mechanisms of protection against chemical and biological agents.

During FY84:

Demonstrated that the impregnation of ASC Whetlerite charcoal with triethylenediamine increased the life of charcoal filters for the adsorption of the blood agent, cyanogen chloride. Obtained Surgeon General's approval for the use of such filters.

Investigated alternate methods for the purification of air. These include regenerative systems based upon thermal or pressure swing adsorption/desorption.

Developed a method for the analysis of triethylenediamine on activated charcoal.

Demonstrated the feasibility of using electrical discharge plasmas to destroy agent/simulant vapors.

Test validated the effectiveness of entry/exit procedures for the M1E1 tank and use of M1 mask bag in entry/exit. Characterized the hazard created by vapors adsorbed by clothing during entry.

Evaluated the Soviet Canister.

(2) Warning and Detection Investigations

Reconnaissance, Detection, and Identification

The objective is to evolve new concepts for reconnaissance, detection, warning and identification of all known and future chemical, toxin and biological agents for joint service application. The objective also includes efforts to increase sensitivity, specificity and ease of use of detectors and to minimize the number of detectors in the field.

During FY84:

Conducted field testing of breadboard infrared (IR) laser systems at Dugway Proving Ground. Testing demonstrated detection of simulant vapor clouds and liquid simulant contamination on surfaces. Initiated the development of a miniaturized IR laser detection system model.

Performed preliminary evaluation of an atmospheric pressure ionization tandem mass spectrometer and an ion mobility spectrometer to detect certain chemical, biological and mycotoxin compounds.

Conducted experiments for detecting simulant chemical agents with helicopter mounted M43A1 detectors.

Developed the advanced development plan of new ground Nuclear Biological Chemical Reconnaissance System.

Collected experimental data on chemical agent flux from contaminated natural and synthetic materials for use in development of detectors. Conducted search to identify known chemical agent toxicological data. Initiated preparation of agent environmental models.

(3) Medical Defense Against Chemical Agents

The purpose of this program is to perform the exploratory development of selected technologies and methodologies to minimize vulnerability and maximize the survivability of soldiers and patients on the battlefield. These technologies include advanced engineering practices, nonhuman testing of selected chemical warfare protective products, pharmacology and toxicology of protective drugs and laboratory preparation of reserach quantities of test drugs for initial drug screening. Specifically, the objectives are to conduct research to define drug/agent interactions and preliminary decontamination studies.

During FY84:

Developed methodologies to permit in vivo assessment of candidate skin decontaminants in rabbits.

Studied Food and Drug Administration licensed organophosphorus chemical agent antidote in man and animals.

Assessed effects of skin viability on percutaneous penetration of agents.

Agonist desensitization of the acetylcholinesterase receptor indicates that acetylcholinesterase is not the only site of the attack of chemical agents.

Evaluated brain damage in experimental animals following convulsions after nerve agent exposure.

Completed primary screeing of 35 antidotal drugs.

Screened over 200 compounds for efficacy against cyanide. Developed a model for cyanide toxicity.

Synthesized 87 new compounds which were screened for antidotal efficacy.

Completed physical and chemical warfare agent tests of litter cover materials.

b. <u>Advanced Development</u>

(1) Chemical Decontaminating Material

Decontaminating Apparatus, Interior Surface, XM15

This apparatus is being developed to decontaminate chemical and biological warfare agents from the interior surfaces of combat vehicles, shelters, water crafts, electronic equipment, vans, and aircrafts. It will be small, carried on board and used by the crew. It will reduce the contamination to such levels that the personnel may remove the protective mask and the rubber gloves or unbutton the protective overgarment.

During FY84:

Conducted Operational Test I (OT I). Minor design changes were initiated as a result of OT I.

Initiated Development Test I (DT I) follow-on tests. The tests are being conducted to gather more data for preparation of the Cost and Operational Effectiveness Analysis.

Conducted tests at Human Engineering Laboratory (HEL) to determine the potential of operator heat stress during the operation of XM15.

Conducted tests to determine the effects of the XM15 hot air stream on electronic equipment. The tests showed that XM15 hot air stream caused no damage to the equipment.

Decontaminating Apparatus, Truck Mounted, Jet Exhaust, XM16

There is a military need for a decontaminating apparatus to rapidly and effectively reduce Nuclear, Biological and Chemical (NBC) contamination on combat vehicles so that the vehicle crews can reduce the amount of protective clothing and fight more effectively.

The XM16 consists of a J60-P-6 Jet Engine mounted on a hydraulic turntable. Located beside the jet engine is a control cap from which the jet engine's exhaust gases can be moved vertically and horizontally over the surfaces of the contaminated vehicle. An injection nozzle is located at the engine's exhaust for injecting water or smoke-producing liquids.

During FY84:

Tested XM16 for the effects of a nuclear blast using high explosives to simulate the shock wave and a concurrent high-energy heat source to simulate thermal effects.

Provided XM16 to two foreign countries for testing.

Completed Cost and Operational Effectiveness Analysis (COEA) on XM16. The COEA recommended restructuring of the XM16 program to develop a Lightweight Jet Exhaust Decontaminating System (JEDS).

(2) Collective Protection Equipment

Collective Protection Equipment: NBC Simplified, XM20:

The XM20 is designed to convert a room of an existing structure into a positive pressure collective protection chemical biological shelter for ten men. This system will permit the personnel to work without the impediments of overgarment and mask.

During FY84:

Completed Engineering Design Tests and incorporated the necessary equipment modification into the design.

Completed the Development Testing and Operational Testing.

Modified the contract to provide six Development Test Units to the High Technology Test Bed.

Physical Protection Investigations

Multipurpose Overboot (MULO)

The MULO is to replace the current chemical protective footwear cover and the wet weather overshoe by combining the salient characteristics of each boot into a single item. Flame resistance, decontaminability and resistance to petroleum oils and lubricants are to be considered in designing MULO.

During FY84:

Evaluated the suitability of five commercial boots for use as MULO.

Coordinated all efforts with the DOD sponsored MULO International Material Evaluation (IME).

Evaluated five contract proposals and awarded a contract for MULO material development.

Guided the contractor on material development.

Chemical Protective Shelters

During FY84:

Continued work to provide CW protection to nonexpandable Rigid Wall Shelters.

Successfully completed contractor testing of a chemically protected (CP) One-Sided Rigid Wall Shelter.

Tested CW Protective Complexing Kits which permit joining of shelters at a common wall.

(3) Chemical Detection and Warning Material

Automatic Liquid Agent Detector: XM85/86 (ALAD):

This is an automatic liquid chemical agent detector that detects a single droplet (200 micrometer) of blister agents mustard and lewsite and certain nerve agents. This system can operate in two modes: (1) stand alone-in which each individual detector can provide a local alarm, and (2) network-in which a number of detectors (2 to 17) are monitored by a single alarm unit.

During FY84:

Published the reports of Development Test I and Operational Test I.

Drafted the full-scale development requirements document and distributed for comments.

The Cost and Operational Effectiveness Analysis indicated that the ALAD was significantly effective in its proposed role to minimize casualties resulting from liquid chemical agent attacks.

Field tested ALAD along with XM877 trials. Demonstrated successful operation in a field environment.

Remote Sensing Chemical Agent Alarm, XM21 (SCI-REACH):

This system will detect nerve agent clouds at a distance of up to five kilometers. The alarm will automatically scan a 60-degree horizontal arc and operate unattended up to 12 hours.

During FY84:

Designed an advanced development prototype model and fabricated three instruments for advanced development testing. The testing of the design has been conducted successfully by the contractor. Field tests to verify the agent/simulant algorithms, detection of simulant at distances up to five kilometers and to test the ability of the instrument to discriminate against potential interferences have been successfully completed.

Completed advanced development testing with generally favorable results, but additional effort is needed to improve performance and reliability of the cryogenic cooler and thermoelectric generator power supply. The Advanced Development will be completed by the end of FY85.

Automatic Chemical Agent Alarm, XM22:

The objective is to develop a multi-agent alarm with the capability to serve as a point sampling alarm, as a monitor inside collective protected shelters and as a surface monitor to detect contaminated surfaces and determine the effectiveness of decontamination.

The XM22 program was accelerated to end with Type Classification for Limited Production in FY86.

During FY84:

Fabricated study models of the detector to evaluate sensitivity and design ruggedness.

Completed tri-service critical design review.

Initiated the fabrication of Development Test I and Operational Test I prototypes.

Conducted a Joint Services Integrated Logistic Support Review.

(4) Medical Defense Against Chemical Warfare

The objectives of this program are to establish kinetic relationships that will permit formulations of new pretreatment and therapeutic drugs to support new drug applications (NDA) with the FDA; to perform advanced development of chemotherapeutics that will prevent or minimize injury due to chemical warfare agents and to determine the technical and operational effectiveness of the life support equipment.

During FY84:

Evaluated patient wrap fabrics for resistance to chemical warfare agents.

Tested advanced development prototypes for heart rate monitor.

Completed engineering evaluation of two models of the gas-powered resuscitator/ventilator.

Evaluated proposals to develop chemical warfare agent dosimeters.

Assessed the effects of pretreatment compounds on muscle fibers in animals.

Assembled and submitted to the Food and Drug Administration (FDA) an Investigational New Drug (IND) application for a new agent pretreatment compound.

Initiated studies in humans to determine absorption and blood levels of a pretreatment compound against a nerve agent.

Initiated efforts to determine tolerance of blood agent antidotes.

(5) Medical Chemical Defense Life Support Material

Nonsystem Advanced Development:

The purpose of this program is to perform the advanced screening of pretreatment and treatment (P&T) compounds against chemical agents and laboratory preparation of selected compounds. Also included in this area are performance decrement studies, guidelines for drug testing and nonsystem application of advanced engineering concepts. Actions in this area contributed to the fielding of products and equipment for the Services.

During FY84:

Approval has been received to conduct aviator performance studies under the influence of a candidate chemical agent antidote.

Made considerable progress in the efficacy studies of promising chemical warfare pretreatment compounds.

Put on line a real-time computer to process data.

A research facility that can utilize undiluted agent became operational; a second undiluted agent facility has received a contract for construction.

Identified six decontamination compounds for personnel/casualty skin tests for transition into the demonstration and validation phase of the development.

CW agent teratology studies for a nerve agent were found to be negative.

c. Engineering Development

(1) Decontamination Concepts and Materials

Lightweight Decontamination System, XM17:

The XM17 is a portable lightweight (350-pound) decontaminating system which will decontaminate equipment and patients. It is a water heating unit designed to draw water from any source and deliver it at controlled temperatures up to 120^{o} and pressures up to 100 psig. The unit is supplemented by a 145-pound kit containing hoses, cleaning jets, personnel shower hardware and a collapsible water tank with a capacity of 1580 US gallons.

During FY84:

Approved type classification for limited production to meet the need of the item in Europe and Korea.

Awarded a contract for the procurement of the FY84 quantity of 128 items.

Procurement decision for FY85 and FY86 quantities will be made at a Special In-Process Review (IPR).

Decontaminating Apparatus, Diesel Powered Skid Mounted, XM18:

This apparatus will be used for the decontamination of equipment, personnel, and to a limited extent, terrain. It will also serve as a water pumper, firefighter and mobile bathing unit. It will use diesel engine power and will be skid mounted. Essentially, it will consist of three components: a stainless steel storage tank (approximately 450 gallons), a hybrid steam generator/water heater and 50 to 90 gallon-per-minute main pump unit.

During FY84:

Fabricated a prototype system which underwent initial tests to assure that the required criteria were met. The identified inadequacies of the system were corrected.

Four units are being fabricated to undergo contractor testing.

Plans for Development Test II are being finalized.

Decontamination Kit, Individual Equipment, XM280 (DKIE):

The objective is to develop a decontamination kit for a soldier's personal equipment. This kit will decontaminate mask/hood, protective gloves, footwear, weapon, helmet, and load-bearing equipment to preclude agent transfer during doffing of the chemical biological protective ensemble.

The DKIE will consist of a container less than one cubic foot in size and weigh less than 60 pounds. It will contain twenty individual packages. Each package will contain two foil packed decontaminant impregnated towelettes. The individual package will be small and rugged enough to be carried in the trouser pocket of the Battledress Overgarment.

During FY84:

Approved the letter requirement.

Integrated Logistic Support (ILS) Plan and Test Evaluation Master Plan were approved.

The acquisition strategy was approved by a panel from Chemical Research and Development Center.

Wrote the development contract and reviewed contract proposals.

Awarded a contract to fabricate 1,000 exploratory demonstrators.

(2) Collective Protection Systems

Modular Collective Protection Equipment (MCPE):

The modular collective protection equipment consists of a family of end items: three different sized filter units, four protective entrances and a static frequency converter. MCPE provides nuclear, biological, and chemical protection by providing filtered air under positive pressure to vans, vehicles, and shelters to prevent the infiltration of toxic chemicals, biological agents and radioactive aerosols. A collapsible protective entrance which is pressurized in the same manner provides entry/exit capabilities for these vans, vehicles, and shelters. Pressurization is provided by the filter units and is automatically maintained. Generally, the basic units are installed outside the protected area while the controls are located inside.

During FY84:

Identified additional systems which brought the total to 102 van and shelter systems requiring Chemical Biological Protection.

Awarded eight major production contracts for various MCPE systems.

Completed the development of the Hermetically Sealed Filter Unit (HSFU). This is now available for application to vans and shelters. The HSFU will be type classified along with the first host system application.

Completed the critical design review for 100-cfm Gas Particulate Filter Unit, 200-cfm dust separator and the internal and external protective entrance.

Completed fielding of MCPE with TACFIRE in Korea, Germany, and Ft. Bragg, NC. The total MCPE fielded to date with TACFIRE is 87 systems.

(3) Warning and Detection Equipment

Simulator, Detector Unit, Chemical Agent, Automatic Alarm, XM81:

The XM81 is a training device for use with M8 automatic chemical agent alarm. It will be remotely activated by a handheld battery-operated radio transmitter. The device will be capable of being selectively activated to simulate agent cloud travel during field training exercises. It will use normal field procedures for the M8 alarm system and will be sturdy enough for field operations.

During FY84:

Conducted Pre-Operational Test II A. Improved design based upon these test results.

Conducted a readiness for test review.

Conducted Operational Test II A.

Updated Technical Data Package. Initiated first-buy procurement efforts.

Chemical Agent Monitor (CAM):

The objective is to conduct an International Materiel Evaluation (IME) of the UK developed CAM to achieve early fielding (FY87) of a contamination monitor. The monitor will detect, locate and identify chemical agent vapor contamination emanating from equipment, personnel, and surfaces. The CAM detection principle is based on ion mobility spectrometry. Microprocessor techniques are used to detect, identify and indicate the relative amount of contamination and reject interferences.

During FY84:

Completed the Operational Feasibility Test.

Completed Technical Feasibility Testing at all sites except one.

Reviewed UK test data for evaluation of the item by Test and Evaluation Command.

Conducted negotiations with Graseby Dynamics, Ltd, on agreement rights with regard to competitive procurement, spare parts, item cost and US production. A US team inspected the contractor's technical data package (TDP). A copy of the TDP has been forwarded to the US.

(4) Individual Protection Equipment

Mask, Chemical and Biological, Multipurpose, XM40:

The XM 40 will provide protection for the face, eyes, and respiratory tract against field concentrations of chemical and biological agents in vapor or aerosol form, toxins, infrared screening smokes, radioactive fallout particles and combinations thereof. This mask will fit better and provide improved protection. It will have an easily replaceable filter. It will replace M17 field protective mask, the M24 aircraft mask, the M25A1 combat vehicle mask, the M9A1 Special Purpose Mask and the Navy Mark V Mask.

During FY84:

Two versions of US developed XM40's and a British developed S-10 respirator were selected as competing prototypes. The development contractors completed design studies, fabricated tooling and test items and prepared a Technical Data Package. An Engineering Design Test (EDT) to determine the potential of the final engineered prototypes is in progress. The results of the EDT will be presented to a Readiness for Test Review (RFTR) which will determine the acceptability of the prototype(s) for entry into Development Test II (DT II) and Operational Test II (OT II). Extensive preparations have been made at the DT II and OT II test sites.

Physical Protection Investigations

Tactile Glove (TG)

The development of a tactile protective glove is meant to replace the standard chemical protective glove for tasks which require a high level of tactility and dexterity.

During FY84:

Evaluated thin butyl rubber gloves and combination epichlorohydrin/butyl rubber gloves.

Evaluated commercial glove liners for use with TG.

Wear tested the candidate gloves. The toxic agent testing of these will be performed.

Performed human factors evaluations which indicated the effects of glove thickness on durability and performance degradation. This data along with the chemical agent data will be used to choose the optimum glove and thickness.

NBC Carrying Bag:

The NBC carrying bag is designed to carry the chemical protective overgarment, gloves, and boots in a single compact, adjustable bag that interfaces with the current load carrying equipment.

During FY84:

Fabricated prototype items for testing at Human Engineering Laboratory (HEL).

Modified several design features based on HEL's suggestions.

HEL tested the modified bags.

The development of the item is complete. Currently awaiting presentation to the Clothing Advisory Group (CAG) and Army Clothing and Equipment Board (ACEB).

d. Testing

(1) Materiel Test in Support of Joint Operational Plans and/or Service Requirements:

No obligations were incurred.

(2) Army Material Suitability Tests

Decontaminating Apparatus, Diesel Powered, Skid Mounted, XM18:

Preparations for the reliability, maintainability, functional and decontamination testing of XM18 (to be conducted in FY85 at Dugway Proving Ground) are being made.

Decontaminating Apparatus; Interior Surface, XM15:

Performed Development Test I Follow-On Tests at Dugway Proving Ground to determine the decontamination effectiveness of XM15. The data obtained will supplement the data generated from the Development Test I for the preparation of Cost and Operational Effectiveness Analysis.

Conducted the electronic compatibility tests at Electronics Proving Ground, Fort Huachuca, AZ, to determine the effects of XM15 hot air stream on electronic equipment.

Decontaminating Apparatus, Power Driven, Lightweight: XM17

Carried out Initial Production Test (IPT) at Cold Regions Test Center (CRTC) and Dugway Proving Ground (DPG).

5. Training Support

a. Training

Simulator, Projectile, Airburst, Liquid, M11 (M11 SPAL):

The M11 SPAL is a training airburst device designed to simulate an artillery chemical agent attack. The M11 SPAL is launched from a liquid airburst projectile launcher. Disseminated droplets are detected on the detector paper on the soldier outergament.

During FY84:

Type classification was completed. First production is scheduled for FY85.

6. SIMULANT TEST SUPPORT

Efforts were directed toward planning, conducting and reporting on joint tests and operational research studies performed to meet the requirement of the Commander-In-Chief of the Unified and Specified Command. These tests and studies provide useful data on chemical systems and chemical/biological defense materials for the user.

During FY84:

Simulant Review Selection: Continued effort to develop nontoxic materials for use as agent simulants. Published a report entitled "Contamination Density and its Relationship to Local Contamination Level".

Chemical Logistics Evaluation: Evaluated the US Marine Corps Chemical Weapons and Support System. Published a report.

Materiel/Terrain Decontamination Evaluation: Completed a search for the best techniques using West Germany's C8 emulsion decontaminant, other decontaminants and apparatus for decontaminating various equipment and terrain. Further study is dependent upon the availability of test facilities.

Performance Degredation in a Contaminated Environment: Testing as to how well the soldiers function while wearing chemical/biological protective clothing and masks will begin in early FY85.

Aircraft Operations - Toxic Environment: Determined the hazards of a toxic milieu to aircraft operations on the ground and aloft after a chemical attack. Further tests are scheduled for FY85.

Effectiveness of Missiles Against Ships: The purpose of this study was to assess the effectiveness of chemical weapons against naval forces. Published a report on the analysis of amphibious and cruiser/destroyer operations.

Effectiveness of Decontaminants on Air Defense Equipment: Published a survey on the effects of chemical agent decontaminants on air defense equipment. The survey indicated the need for further testing.

Chemical Munition/Aircraft Compatibility: Published final report on the compatibility of existing chemical munitions with contemporary aircraft.

Quick Response/Planning Digest: This is a continuing effort. The aim is to produce a quick response to inquiries (e.g., literature searches) from the Department of Defense.

Impact of Dust Storms: Published a report on whether chemical agents transported by fine dust particles present a hazard to personnel.

Chemical Defense Operations in Extreme Cold: A final report on the problems of chemical defense operations in extreme cold conditions is scheduled to be published in early FY85.

Maintenance Operations in a Chemically Contaminated Environment: Conducted tests to determine the performance of maintenance personnel while wearing chemical protective clothing and masks.

Amphibious Operations - Toxic Environment: Conducted a test to determine how well these operations are carried out by personnel wearing protective clothing and masks. A report is scheduled to be published in early FY85.

Aqueous Film Forming Foam: Initiated a study to determine if this firefighting material can be used as an effective decontaminant for chemical agents.

Effectiveness of Chemical Bombs: Initiated a study to determine the effectiveness of chemical bombs delivered by jet aircraft against selected targets.

Protection Provided by Buildings: Began a study as to how buildings with and without air conditioning protect the inhabitants from chemical agents.

Decontamination Summary: Started a study to answer interrelated questions about techniques for chemical agent decontamination.

Effects of Liquids on M17A1 Drinking Tube: Completed a study as to whether liquids other than water, e.g., electrolyte replacement formulas, promote bacterial growth/ contamination of the drinking tube of the chemical protective mask.

Detection, Alarm and Soldier Interface: A study to determine the efficiency of this man-machine system and the response of the alarm to the chemical agents is in progress.

Electronic Equipment Decontamination: A survey of on-going efforts in industry and Department of Defense to decontaminate electronic equipment contaminated by chemical agents is under progress.

SECTION II

OBLIGATION REPORT ON BIOLOGICAL RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE BIOLOGICAL RESEARCH PROGRAM

During FY84, the Department of the Army obligated $60,399,000 for biological research investigations and the development and test of physical and medical defensive systems.

FUNDS OBLIGATED

Current Fiscal Year (CFY)		$ 35,883,000	
Prior Year (PY)		24,516,000	
			In-House $35,204,000
TOTAL		$ 60,399,000	Contract $25,195,000

Breakdown of Program Areas

1. BIOLOGICAL RESEARCH

a. Basic Research on Life Sciences	CFY	$ 870,000	-
	PY	-0-	
			In-House $ 545,000
		$ 870,000	Contract $ 325,000
b. Medical Defense Against Biological Warfare	CFY	$ 7,809,000	
	PY	6,704,000	
			In-House $ 9,595,000
		$ 14,513,000	Contract $ 4,918,000

TOTAL: BIOLOGICAL RESEARCH	CFY	$ 8,679,000	
	PY	6,704,000	
			In-House $10,140,000
		$ 15,383,000	Contract $ 5,243,000

2. DEFENSE SYSTEMS			
a. Exploratory Development	CFY PY	$ 13,753,000 11,545,000	
		$ 25,298,000	In-House $18,056,000 Contract $ 7,242,000
b. Advanced Development	CFY PY	$ 10,171,000 6,267,000	
		$ 16,438,000	In-House $ 6,074,000 Contract $10,364,000
c. Engineering Development	CFY PY	$ 3,280,000 -0-	
		$ 3,280,000	In-House $ 934,000 Contract $ 2,346,000
d. Testing		-0-	
TOTAL: DEFENSIVE SYSTEMS	CFY PY	$ 27,204,000 17,812,000	
		$ 45,016,000	In-House $25,064,000 Contract $19,952,000
3. SIMULANT TEST SUPPORT		-0-	
4. MANAGEMENT AND SUPPORT		-0-	

1. BIOLOGICAL RESEARCH

a. Basic Research in Life Sciences

The objective of this program is to support the Biological Defense Program and to maintain a technology base for non-medical aspects of biological defense. Effort is also directed toward the appraisal of new concepts for the rapid detection, identification, and decontamination of biological threat agents.

During FY84:

Developed enzymes and enzyme related substances as tools for detection of viruses and microbial toxins.

Obtained new insights into antibody/antigen binding from the chemometric modeling of the nerve agent, soman.

Continued efforts to increase the sensitivity of a new calorimetric method for the detection of trichothescene mycotoxins. This is a simple method and appears fieldable.

Formulated plans to detect biological components of viral particles by enzymatic, chemical, and immunological means.

Spectroscopic studies on aerosolized biological materials showed ultraviolet fluorescence to be a promising technique for point detection.

Detection of pyrolysis products of biologicals spectroscopically was identified as a promising new approach for point detection.

Demonstrated the feasibility of single particle mass spectrometry for biological detection. Measurements were made on carbohydrates, phospholipids, deoxyribonucleic acid and several bacteria by this technique.

b. Medical Defense Against Biological Warfare

Basic Research

This area is being developed to provide the science base information for the advancement of improved systems for the medical diagnosis, treatment, and prevention of biological warfare (BW) casualties on a BW battlefield.

The objectives in this area are: To determine the physio-chemical nature of militarily important bacterial toxins and how they enter the cells and cause their destruction; and develop a scientific base to counteract medically the threat posed by new or existing bacteria and rickettsiae. To evaluate the newly discovered viruses as BW agents or as natural threats in certain geographical areas. These lethal but little understood viruses must be studied in the laboratory where strict containment techniques can be enforced.

The Russian supported use of the deadly trichothescene toxins in Indochina prompted an extensive research program on the medical defense against mycotoxins such as T-2 and marine toxins.

During FY84:

Immunologically protective antigens are coded by the large plasmid in Bacillus anthracis. In vivo data indicate that only B. anthracis strains that contain the large plasmid produce the protective antigen (PA), lethal factor (LF) and the edema factor (EF). Initial data indicate that one or more of the toxin components must be present in a vaccine to elicit immunity to anthrax infection. Segments of the PA gene from sterne strain of B. anthracis successfully cloned into E. Coli. This technology will continue to be exploited because of its application to the development of improved vaccines.

Chloroform-methanol extraction residue of Coxiella burnetti phase I cells remove reactogenic components while maintaining immunogenicity. This approach has been partially cloned using plasmid 1059. This represents another approach for the development of a better Q fever vaccine.

T-2 Toxin did not inhibit protein synthesis in prokaryotic cells such as bacteria but the toxin caused a 70% decrease in protein synthesis in isolated mitochondria. T-2 toxin inhibited gluconeogenesis but not ketogenesis in an isolated liver perfusion system.

Developed gas liquid chromatography (GLC) flame ionization techniques for detection of 50 parts per billion of T-2 toxin and metabolites. It is expected that the sensitivity will improve 1,000 times when GLC is integrated with a mass spectrometer. High Pressure Liquid Chromatography procedures have been developed for the detection of T-2 toxin metabolites.

Rift Valley fever (RVF) virus hybridomas are being characterized to obtain monoclonal antibodies to perform key Rift Valley fever (RVF) virus studies.

Fusion proteins from RVF virus recombinant DNA clones were found to be poor immunogens when tested in animals.

Produced monoclonal antibodies to Korean hemorrhagic fever (KHF) virus. Prepared ascitic fluids and examined those in preliminary characterization assays.

The etiologic agent of nephropathia epidemica virus now adapted to tissue culture is being characterized and compared to the classic KHF virus by means of serologic assays to determine similarities and differences.

Initiated molecular characterization studies with live attenuated vaccine strain of Junin virus, the etiologic agent of Argentine hemmorrhagic fever (AHF). This is the first attempt to study the dangerous and poorly understood Areno virus group at the molecular level.

2. DEFENSIVE SYSTEMS

a. Exploratory Development:

The objectives of this are to perform aerosol assessment of microbial organisms or their toxins to determine their danger as biological warfare (BW) threats and develop medical countermeasures; to develop safe vaccines/toxoids for agents and toxoids that are significant BW threats; to develop effective antiviral drugs; to develop technology to identify a BW agent within six hours or before classic disease symptoms appear and the risk assessment and evaluation of viral agents and their vectors that pose a potential BW threat.

During FY84:

Preliminary data indicate that AJ inbred mice are susceptible to aerosols of anthrax spores. If these promising results continue, then the mouse would replace the guinea pig as an appropriate model. This would be a significant advancement and accelerate the anthrax program.

A new generation nose-only aerosol exposure system was made operational. For the first time, T-2 mycotoxin was successfully disseminated. The aerosol contained sufficient toxin to kill mice. This system requires only small quantities of materials for aerosol assessment.

The Romeo strain of Junin virus was disseminated as a small particle aerosol and was found to be highly infectious and lethal for guinea pigs. These results demonstrate the need for an effective vaccine to protect the armed forces from this dangerous virus.

Established a program on mucosal immunity to obtain data on how the mucosa of the respiratory tract is involved in the host either rejecting or succumbing to an aerosol infection.

Isolated a second plasmid from virulent strains of Bacillus anthracis which plays a critical role in the production of the capsule, an important virulence factor.

Continued pathogenesis studies on ebola virus infections. Contrary to early reports, disseminated intravascular coagulation (DIC) may play only a secondary role in the fatal disease.

Conventional and recombinant alpha-2 interferon protects monkeys against Rift Valley fever (RVF) virus. Both interferons can be produced by recombinant technology and stored. Studies in mice to show maximum time lag between RVF infection and successful interferon prophylaxis are now in progress.

Hantaan virus is now well characterized. It has some properties which indicate that it should be classified with the Bunyaviridae since it has been shown to contain a three segmented, single stranded RNA genome.

Mass spectrometric studies show that urine and not blood is the clinicl specimen of choice for the detection of T-2 mycotoxin. The toxin disappears rapidly from the blood. A metabolite identified as T-2 Tetraol is the key marker for the identification of T-2 mycotoxin.

Showed that activated charcoal given orally to experimental animals represents effective treatment for the T-2 mycotoxin. The charcoal absorbs the toxin in the intestine and prevents it from being reabsorbed into the body thus avoiding the shock and heart failure. Demonstrated that the drugs such as phenobarbital and dexamethasone have some effectiveness in preventing lethality of T-2 mycotoxin in experimental animals.

Completed final evaluation of a human botulism immune globulin against types A, B, C, D, and E. The product is 99% pure human IgG, non-pyrogenic, sterile, and does not induce platelet aggregation.

Identified drug combinations which show synergistic antiviral effects agains a variety of viral infections. The use of drug combinations to overcome the shortcomings of a single drug makes this an important approach in the treatment of human viral infections. A combination of ribavirin and selenazole showed synergistic activity against Venezuelan equine encephalomyelitis, Japanese encephalitis, yellow fever and pichinde viruses. A combination of ribavirin and tiazofurin showed synergistic activity against yellow fever and Japanese encephalitis but only an additive effect against Korean hemorrhagic fever virus. A combination of selenazole and tiazofurin showed additive effects against Japanese encephalitis, yellow fever and Korean hemorrhagic fever viruses.

Two avenues, enzyme immunoassays and gene probes, are currently being pursued for the rapid diagnosis of viruses. The enzyme immunoassay approach has led to the development of first-generation assays to measure antigen and IgM and IgG antibodies for the following viruses: Venezuelan equine encephalomyelitis, sindbis, west Nile, Rift Valley fever, punta tora, charges, Sicilian and Naples strain of sandfly fever and Congo-Crimean hemorrhagic fever. The gene probe program has just gotten underway.

Industrial Base for Biological Warfare

b. Advanced Development (non Systems)

The objectives of this program are to scale up laboratory processes for vaccine preparation into pilot operations; to purchase larger quantities of antiviral drugs for further testing and evaluation; to develop industrial base operations for rapid identification and diagnosis of BW threat agents.

During FY84:

Purified anthrax toxin components (PA, LF, EF) were tested alone and in combinations for ability to immunize guinea pigs against a lethal spore challenge. The PA and EF combination was more effective than PA alone indicating that the present licensed human vaccine (PA) can be improved by addition of EF.

Obtained hybridomas which produce mouse monoclonal antibodies to anthrax spores, capsules and vegetative cells. The ability to prepare unlimited amounts of antibodies specific for surface antigens of Bacillus anthracis will make it possible to produce simple, portable kits for detection of this important BW agent.

A research program between the United States and Israel has yielded an attenuated RVF strain with some promise as a vaccine. Mouse and hamster tests were promising. Sheep and monkey studies are in progress. In other RVF studies, monoclonal antibodies have been placed in five groups depending on their biological properties and site competition studies.

The efficacy of candidate Junin virus (AHF) vaccine was evaluated in three strains of guinea pigs and a protection dose (PD_{50}) of about 34 plaque forming units was observed. This low PD_{50} reflects an exceptionally protective vaccine. The vaccine, when administered to monkeys, stimulates neutralizing antibody by day 56 postvaccination. Monkeys will soon be challenged to determine PD_{50}. These results will be used to establish the concentration of virus for packaging the human-use vaccine. The long-term study of the vaccine is nearing completion. Monkeys appeared normal throughout the 7-1/2 month test period. Histopathological studies are in progress on both vaccinated and control animals.

Formal testing of sequentially obtained SERA from human Lassa-convalescent patients confirmed the generalization drawn from experimentally infected primates regarding neutralizing antibodies expressed as log neutralization index (LNI) with regard to criteria for selection of plasma for immunotherapy of Lassa fever.

In other Lassa fever therapy studies, all 170 plasma units from Liberia were serologically tested for Lassa, antibodies, hepatitis B surface antigen and also for autoimmune deficiency disease (AIDS). Markers for AIDS include testing for human T-cell leukemia virus and acid labile interferon. A good supply of human Lassa fever immune plasma is now available.

Completed in vitro evaluations of the human botulism immune globulin. In vivo evaluation in a mouse system showed that a dose of 15 mg antibody protein/kg body weight can protect mice if given within two hours after type A toxin challenge. Delayed treatment results in higher mortality. It was concluded that this approach to botulism therapy is not viable for biological warfare.

Made advances in the treatment of viral infections using new antiviral drug delivery systems.

Developed specific immunological assays for antibodies to anthrax spores, polysaccharide and polyglutamic acid capsule. These assays have detected antibodies in immunized animals.

The development of a prototype identification kit for field identification of Rift Valley fever (RVF) virus is in progress.

Drug and Vaccine Development:

Advanced Development (Systems)

The objectives of this program are to scale up laboratory processes for specific vaccine preparation into industrial-scale operations; to prepare pilot quantities of specific vaccines for testing, for administration to "at risk" workers and storing moderate quantities for use in emergencies; to document vaccine scale-up procedures from laboratory to industrial scale; to establish industrial base operations for rapid identification and diagnosis of specific biological warfare threat agents; to establish industrial base operations for therapeutic and prophylactic regimens for man against natural infections of military importance and potential BW agents.

During FY84:

1. The majority of funds for this project were used to fund a contract with The Salk Institute. Following work was done at The Salk Institute.

Produced chloroform-methanol residue of Q fever skin test antigen. Preparation of reports supporting investigational new drugs is in progress.

Produced mouse ascitic fluids containing monoclonal antibodies specific for lymphocyte hybridomas.

Screened 200 antiviral drugs for their effectiveness against Japanese B, Rift Valley fever, Venezeulan equine encephalomylitis (VEE), pichidine, vesicular stomatis, sand fly fever, Korean hemorrhagic fever and yellow fever viruses.

Prepared reagents and spot slides for rapid diagnosis of Korean hemorrhagic fever and Rift Valley fever viruses.

Initiated studies to stabilize the live, attenuated Junin virus vaccine.

Performed tests on certified cell lines and viability tests on stored vaccines.

Produced beta-propiolactone inactivated antigen for rapid diagnosis group.

2. Initiated advanced development of hardware portions of rapid identification of VEE, RVF, Plaque, Coccidioid, Q fever and other agents of differential diagnostic interest.

3. Purchased 23 lots of monoclonal antibody for testing and development of hardware for the rapid diagnostic systems.

c. Engineering Development:

The objectives of this program are to standardize a production process for a specific vaccine or drug to produce in sufficient quantities so as to perform phase II and phase III clinical trials; to purchase as a first buy 2,000,000 doses of the vaccine or drug for US forces; to standardize a production process for a specific system for the rapid diagnosis of BW agents. This may lead to the type classification of the process.

During FY84:

Two million doses of tularemia vaccine are in final stages of production and will be stockpiled.

SECTION III

OBLIGATION REPORT ON ORDANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE ARMY

RCS: DD-USDRE (A) 1065

DESCRIPTION OF RDTE EFFORT FOR THE ORDNANCE PROGRAM

During FY84, the Department of the Army obligated $6,293,000 for general research investigations, development and test of smoke, riot control agents and weapons systems.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$ 6,293,000
Prior Year (PY)	-0-
TOTAL	$ 6,293,000

In-House $ 4,941,000
Contract $ 1,352,000

Breakdown of Program Areas

Smoke Program	$ 6,270,000
Riot Control Program	-0-
Test Support	$ 23,000

DESCRIPTION OF PAA EFFORT FOR THE ORDANCE PROGRAM

During FY84, the Department of the Army obligated $18,444,000 for procurement of smoke/obscurants, riot control agents, weapons systems and other support equipment.

FUNDS OBLIGATED

Current Fiscal Year (CFY)	$ 14,328,000	
Prior Year (PY)	4,116,000	
TOTAL	$ 18,444,000	In-House $ 8,375,000 Contract $ 10,069,000

Breakdown of Program Areas

Smoke/Obscurants Program	$ 7,526,000
Riot Control Program	$ 671,000
Other Support Equipment	$ 10,247,000

ANNEX B

DEPARTMENT OF THE NAVY

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

RCS: DD-USDRE(A)1065

SECTION I

OBLIGATION REPORT ON CHEMICAL WARFARE PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE NAVY

RCS: DD-USDRE(A)1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT,
TEST AND EVALUATION FUNDS FOR THE PERIOD
1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984
REPORTING SERVICE: DEPARTMENT OF THE NAVY
DATE OF REPORT: 30 SEPTEMBER 1984
RCS: DD-USDRE(A)1065

DESCRIPTION OF EFFORT: RDT&E	FUNDS OBLIGATED ($ in Millions) PY / CFY	IN-HOUSE / CONTRACT
1. CHEMICAL WARFARE PROGRAM	.007 / 22.874	14.389 / 8.492
a. Defensive Equipment Program	.007 / 13.405	9.844 / 3.568
(1) Chemical Research	0 / 2.837	.369 / 2.468
(2) Exploratory Development	.003 / 2.958	2.525 / .436
(3) Advance Development	.004 / 0	0 / .004
(4) Engineering Development	0 / 7.610	6.950 / .660

EXPLANATION OF OBLIGATION

FUNDS SUPPORT: (a) Defense requirements analysis. (b) Development and evaluation of automated chemical agent warning/detection/monitoring systems. (c) Design and installation of critical components of shipboard chemical collective protection systems. (d) Procurement and evaluation of individual chemical warfare protective ensemble (boots, gloves, mask, overgarment, hood, etc.). (e) Develop/evaluate contamination control procedures, materials (wet and dry chemicals) and equipment. (f) Joint service chemical defense programs monitoring and participation. (g) Base of expertise maintenance.

DESCRIPTION OF EFFORT: RDT&E (Cont'd)	FUNDS OBLIGATED ($ in Millions) PY CFY	IN-HOUSE CONTRACT	EXPLANATION OF OBLIGATION
b. Offensive Equipment Program	0 9.469	4.545 4.924	IN-HOUSE EFFORT FY-1984: (a) Completed design changes to modify BIGEYE Weapon to the off-station mixing (OSM) configuration. Revised drawings as appropriate. (b) Completed electromagnetic testing of BIGEYE and FMU-140 Fuze. (c) Commenced Technical Evaluation of BIGEYE. Completed portions of dissemination testing and environmental testing. (d) Commenced container testing program. (e) Completed off-station mixing (MIXMASTER) flight testing and evaluation program. (f) Completed a portion of the Safe Separation Test Series on the A6-E Aircraft. This effort will be completed in the first quarter of FY-85. (g) Continued tests of toxic agent generation in an enclosed chamber. (h) Provided for Integrated Logistics Support (ILS). CONTRACT EFFORT FY-1984: (a) Continued modification of technical evaluation and operational test prototype weapons to the off-stations mixing concept. Major modifications included incorporation of a mix initiation device to start the mixing sequence on release from the aircraft and incorporation of the FMU-140/B Proximity Fuze to enhance delivery capability. (b) Incorporated modifications as appropriate to correct technical deficiencies and provide expanded capabilities to prototype weapons and safe separation test vehicles. (c) Provided engineering evaluations of hardware and weapon components.
(1) Chemical Research	0 0	0 0	
(2) Exploratory Development	0 0	0 0	
(3) Advanced Development	0 0	0 0	
(4) Engineering Development	0 9.469	4.545 4.924	

SECTION II

OBLIGATION REPORT ON BIOLOGICAL RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE NAVY

RCS: DD-USDRE(A)1065

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984
REPORTING SERVICE: DEPARTMENT OF THE NAVY
DATE OF REPORT: 30 SEPTEMBER 1984
RCS: DD-USDRE(A)1065

DESCRIPTION OF EFFORT: RDT&E	FUNDS OBLIGATED ($ in Millions) PY / CFY	IN-HOUSE / CONTRACT	EXPLANATION OF OBLIGATION
1. BIOLOGICAL RESEARCH PROGRAM	0 / 2.101	.478 / 1.623	
a. Defense Equipment Program			FUNDS SUPPORT
(1) Biological Research	0 / 2.101	.478 / 1.623	Research provides understanding of materials, devices, and analytical techniques needed for biological warfare defense.
(2) Exploratory Development	0 / 0	0 / 0	

SECTION III

OBLIGATION REPORT ON ORDNANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE NAVY

RCS: DD-USDRE(A)1065

NEGATIVE

ANNEX C

DEPARTMENT OF THE AIR FORCE

ANNUAL REPORT ON

CHEMICAL WARFARE - BIOLOGICAL DEFENSE RESEARCH PROGRAM OBLIGATIONS

1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

RCS: DD-USDRE(A) 1065

SECTION I

OBLIGATION REPORT OF

CHEMICAL WARFARE LETHAL AND INCAPACITATING AND DEFENSIVE EQUIPMENT PROGRAMS

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

RCS: DD-USDRE(A) 1065

DEPARTMENT OF THE AIR FORCE

30 SEPTEMBER 1984

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS
FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1984
RCS: DD-USDRE(A) 1065

DESCRIPTION OF EFFORT RDT&E	FUNDS OBLIGATED ($ In Millions) PY / CFY	IN HOUSE / CONTRACT	EXPLANATION OF OBLIGATIONS
Offensive RDT&E Program			
Research	.000 / .000	.000 / .000	
Exploratory Development	.000 / .000	.000 / .000	
Advanced Development	.000 / .000	.000 / .000	
Engineering Development	.000 / .120	.000 / .120	The BIGEYE binary chemical munition is a joint-development program with the Air Force acting as lead service. The Air Force tests and certifies the weapon's compatability with selected Air Force aircraft.
Total Offensive RDT&E	.000 / .120	.000 / .120	

OBLIGATION REPORT OF RESEARCH, DEVELOPMENT, TEST AND EVALUATION FUNDS
FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984
REPORTING SERVICE: DEPARTMENT OF THE AIR FORCE
DATE OF REPORT: 30 SEPTEMBER 1984
RCS: DD-USDRE(A) 1065

DESCRIPTION OF EFFORT RDT&E	FUNDS OBLIGATED ($ In Millions) PY CFY	IN HOUSE CONTRACT	EXPLANATION OF OBLIGATIONS
Defensive Equipment Program			
Research	.000 .000	.000 .000	
Exploratory Development	.000 3.463	.087 3.376	
Advanced Development	.240 5.425	.514 4.911	
Engineering Development	1.161 17.771	1.712 16.059	The program is composed of biological and chemical agent detection, individual protection, collective protection, decontamination and basic operational and medical problems associated with chemical warfare operation.
Total Defensive (RDT&E)	1.401 26.659	2.313 24.346	

SECTION II

OBLIGATION REPORT ON BIOLOGICAL RESEARCH PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE AIR FORCE

RCS: DD-USDRE(A) 1065

30 SEPTEMBER 1984

N E G A T I V E

SECTION III

OBLIGATION REPORT ON ORDNANCE PROGRAM

FOR THE PERIOD 1 OCTOBER 1983 THROUGH 30 SEPTEMBER 1984

DEPARTMENT OF THE AIR FORCE

RCS: DD-USDRE(A) 1065

30 SEPTEMBER 1984

N E G A T I V E

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